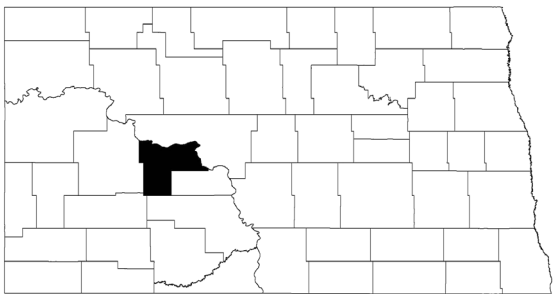
# FLOOD INSURANCE STUDY

# MERCER COUNTY, NORTH DAKOTA
## AND INCORPORATED AREAS



| Community Name | Community Number |
|---|---|
| BEULAH, CITY OF | 380066 |
| GOLDEN VALLEY, CITY OF | 380175 |
| HAZEN, CITY OF | 380067 |
| PICK CITY, CITY OF | 380279 |
| STANTON, CITY OF | 380250 |
| ZAP, CITY OF | 380068 |
| THREE AFFILLIATED TRIBES | 380721 |
| MERCER COUNTY UNINCORPORATED AREAS | 380294 |

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
38057CV000A

**NOTICE TO**
**FLOOD INSURANCE STUDY USERS**

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Selected Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross sections). In addition, former flood hazard designations have been changed as follows:

| Old Zone | New Zone |
|---|---|
| A1 through A30 | AE |
| V1 through V30 | VE |
| B | X |
| C | X |

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components.

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index

Flood Insurance Rate Map

**FLOOD INSURANCE STUDY**
**MERCER COUNTY, NORTH DAKOTA AND INCORPORATED AREAS**

# 1.0 INTRODUCTION

## 1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Mercer County, North Dakota, including the Cities of Beulah, Golden Valley, Hazen, Pick City, Stanton, and Zap as well as the unincorporated areas of Mercer County (referred to collectively herein as Mercer County) and the Three Affiliated Tribes Fort Berthold Reservation and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood hazard data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Mercer County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

## 1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

In November of 1977, Webster, Foster, & Weston completed the hydrologic and hydraulic analyses for identification of the flood hazard for the City of Zap including the detailed study of Spring Creek under Contract No. H-3991.

The Soil Conservation Service (currently the Natural Resource Conservation Service) completed the hydrologic and hydraulic analyses for the identification of the flood hazard within the City of Hazen under Inter-Agency Agreement No. IAA-H-9-76 Project Order No. 8 in January, 1977. Additional hydraulic analysis was subsequently performed by the Soil Conservation Services on Antelope Creek which reflected the construction of the Hazen By-Pass Dike Flood Prevention Project.

Under the same inter-agency agreement, the Soil Conservation Service completed the hydrologic and hydraulic analyses for the identification of the

flood hazard within the City of Beulah. This work was completed in February, 1977.

The hydrologic and hydraulic analyses for this revision was performed by Houston Engineering, Inc. (HEI) for the North Dakota State Water Commission (NDSWC) and the Federal Emergency Management Agency (FEMA) under contract EMD-2005-GR-0572. This study was completed in October, 2007.

Base map information shown on the county-wide DFIRM was derived from 2005 aerial photography obtained from the United States Department of Agriculture – Farm Service Agency. The aerial photography has a pixel resolution of 1 meter. Hydrology information for the county-wide DFIRM was obtained from the USGS Hydrography Data Set.

## 1.3 Coordination

A Pre-Scoping Report was prepared on behalf of FEMA by Michael Baker Jr., Inc, in March, 2005. As part of the pre-scoping process, communities were contacted by letter with some follow up phone contacts.

The initial Consultation Coordination Officer (CCO) meeting for the county-wide DFIRM was held on July 18, 2005 in Hazen, North Dakota. The meeting was attended by representatives of the SWC, FEMA, as well as Mercer County and the Cities of Beulah and Hazen. The scope of the project was discussed along with individual community needs, potential local contributions, and mapping format preferences.

The results of this study were reviewed at the final CCO meeting held on _____and attended by representatives of FEMA, SWC and the incorporated communities. All issues raised at that meeting have been addressed in this study.

For the original study of Zap, the community base map was selected and the streams requiring detailed study were identified at meetings attended by personnel of the study contractor, the Federal Insurance Administration, the North Dakota State Water Commission (SWC), and the City of Zap. The results were reviewed at a final community coordination meeting held on August 8, 1978 attended by representatives of the Federal Insurance Administration, the study contractor, and the city.

For the original study of Hazen, a public coordination meeting was held on March 15, 1976. The final coordination meeting was held on January 13, 1977 and was attended by residents of the community, the study contractor, and representatives of the Federal Insurance Administration.

For the original study of Beulah, the original public coordination meeting was held on March 15, 1976. The final community coordination meeting was held on January 13, 1977 and was attended by city officials, local residents, and representatives of the Federal Emergency Management Agency (FEMA) and the Soil Conservation Service.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This FIS covers the geographic area of Mercer County, North Dakota, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development.

The original study for the City of Beulah included detailed study of 6.2 miles of the Knife River. Out of the total 6.2 miles, 1.6 miles was located outside the extraterritorial limits of the City and was not included in the FIRM published at that time. The original study also included detailed study on 0.6 miles of East Tributary and 1.2 miles of West Tributary as well as approximate study on another 1.1 miles of West Tributary and approximately 2.5 miles on East Tributary. Portions of additional unnamed tributaries were studied by approximate methods.

The original study for the City of Hazen included detailed study of approximately 4.6 miles of the Knife River and 5.5 miles of Antelope Creek. Portions of both stream reaches were outside the extraterritorial limits of the city and thus were not mapped on the FIRM. Several smaller unnamed tributaries were studied by approximate methods.

The original study for the City of Zap included 4.1 miles of detailed study on Spring Creek. Other unnamed tributaries were studied by approximate methods.

In addition to these three studies a FHBM for the unincorporated areas of Mercer County was published and was converted to a FIRM by letter dated April 29, 1998. More than 450 miles of approximate Zone A were mapped for the unincorporated areas.

The current study effort, completed as part of the county-wide DFIRM, includes 0.8 mile of detailed restudy along the East Tributary and 2.7 miles of limited detail study along the East Tributary and North Tributary within the City of Beulah. It also included approximately 8 miles of detailed study along Antelope Creek, the Antelope Creek Split, and 3 tributaries to Antelope Creek within the City of Hazen. In addition, approximately 79 miles of approximate Zone A was refined along the Knife River, Spring Creek, Antelope Creek, and several small tributaries in the Unincorporated Areas of Mercer County. New Zone A floodplain was developed along Lake Sakakawea within the Three Affiliated Tribes Reservation Boundary.

### 2.2 Community Description

Mercer County is located in the west central portion of North Dakota, approximately 50 miles northwest of Bismarck North Dakota. It is bound on the north by Lake Sakakawea, on the west by Dunn County, on the south by Morton and Oliver Counties, and on the east by the Missouri River. The total land area

within the county is approximately 1,045 square miles. The 2000 Census county population was 8,644 (Reference 24). The economy of the county depends primarily on agricultural and energy industry related enterprises.

Much of the county is drained by the Knife River and its tributaries with the exception of the northern part of the county which drains directly to Lake Sakakawea and the northeastern portion which drains directly to the Missouri River. Spring Creek is the largest tributary to the Knife River. The other significant tributaries include Antelope and Coyote Creeks. The Knife River flows primarily from west to east to its confluence with the Missouri River near Stanton.

Mercer County is an area of glacially modified bedrock topography. Glacial deposits include unsorted drift in the form of ground moraine and hummocky moraine and sorted drift which is present in the valleys. Bedrock formations exposed in the county include the Cannonball, Tongue River, Sentinel Butte, and Golden Valley Formations. Physiographically this area is in the Missouri Slope District of the Glaciated Missouri Plateau of the Central Lowland Province (Reference 10).

The climate of Mercer County is a continental climate typical of the northern great plains. The mean annual temperature is 40.6$^{o}$F with extremes of -52$^{o}$F and 111$^{o}$F having been recorded within the county. The mean temperatures are 10.3$^{o}$F in January and 69.5$^{o}$F in July. The mean annual precipitation is 15.5 inches of which approximately 72% falls during the growing season. The average growing season is 121 days in duration with the average date of last killing frost falling on May 21 and the first killing frost on September 19 (References 22, 23).

The City of Beulah is located in central Mercer County. Beulah is the largest city in Mercer County with a population of 3,152 according to the 2000 census. The City of Hazen is the second largest city with a population of 2,457. The City of Zap is located west of Beulah with a population of 237. Other cities include Stanton, the county seat, with a population of 345, Golden Valley with a population of 186 and Pick City with a population of 166 (Reference 24). A portion of the Fort Berthold Reservation is also located in the northwest corner of Mercer County.

## 2.3 Principal Flood Problems

Most of the flooding in Mercer County occurs as a result of spring snowmelt. Spring Creek, the Knife River, and Antelope Creek are the primary sources of flooding within the cities of Zap, Beulah, and Hazen respectively. Other smaller tributaries are also potential flooding hazards in the rural areas.

Flooding in the City of Zap has typically been the result of rapid snowmelt. Spring Creek, with a drainage area of 549 square miles, is the primary source of flooding for Zap. Floods were documented in 1902, 1913, 1943, 1950-1953, 1960, 1969, 1972 and 1976. The gaging station at Zap recorded flows of 6,130 cubic feet per second (cfs) in 1952 and 6,030 cfs in 1972. Although a gaging

station was not in operation at the time, the 1913 flood was estimated at 6,000 cfs. In 1902 an ice jam related flood event resulted in the highest flood level for the Zap area (Reference 21).

The largest peak flow of record on the Knife River at Beulah occurred in June, 1966 and was the result of rainfall in the upper portion of the watershed. Other significant floods occurred in March, 1943; April, 1950; April, 1952; and March, 1972. Earlier floods occurred in 1884 and 1897. The East and West Tributaries also flooded in Beulah in July, 1938 and July, 1969 (Reference 23).

The summer rain event of June, 1966 also produced the largest flood event on the Knife River at Hazen. The other significant flood events on the Knife River at Hazen mirror the events at Beulah. Other tributaries have been sources of flooding in Hazen as well. Antelope Creek flooded in July, 1938 and July, 1969 prior to construction of the Hazen By-Pass Dike Flood Prevention Project (Reference 22).

### 2.4 Flood Protection Measures

In Beulah, temporary levees were built in the past to provide some measure of flood control from the East and West Tributaries. While portions of these levees may remain, they do not meet FEMA standards. Also, a dry dam, referred to as Beulah Dam, was constructed on East Tributary to provide a downstream flood control benefit. At the time of construction, it was estimated to reduce the 1-percent chance peak discharge at the dam site from 710 cfs to 50 cfs (Reference 20).

In Hazen temporary levees were once constructed on the west side of Hazen to provide flood control relief from Antelope Creek. These efforts were no longer required once the Hazen By-Pass Dike Flood Prevention Project was constructed. This project combines channel improvements with a highway/dike to contain the 100-year flood on the north side of State Highway 200 (Reference 22).

No significant flood protection measures have been constructed in Zap or in the unincorporated areas of the county.

## 3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that

equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

## 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Knife River

For the original study of the flooding hazard along the Knife River in the Cities of Beulah and Hazen, the 10-, 2-, 1-, and 0.2-percent chance peak discharges were estimated through analysis of the streamflow records at the Spring Creek at Zap, Knife River near Golden Valley, and Knife River near Hazen gages. These gages at that time of the original study had 28, 35, and 45 years of record respectively (References 22 and 23).

Spring Creek

For the original study of Spring Creek, the 10-, 2-, 1-, and 0.2-percent chance peak discharges were estimated using 28 years of record at the USGS Gaging Station located near Zap. These data were statistically analyzed using the Log-Pearson Type III Method (Reference 21).

Antelope Creek

For the original study of the flooding hazard along Antelope Creek in the City of Hazen, the 10-, 2-, 1-, and 0.2-percent chance peak discharges were estimated through analysis of the streamflow records at the Spring Creek at Zap, Knife River near Golden Valley, and Knife River near Hazen gages. These gages at that time had 28, 35, and 45 years of record respectively. The Hazen Plotting Point Method was the basis of this frequency analysis (Reference 22).

For the current study, the 10-, 2-, 1-, and 0.2-percent chance peak discharges for the reach of Antelope Creek being studied by detailed methods were estimated using USGS regression equations (Reference 28). The regression based discharges were compared to the FIS discharges from the original study and the new values were not statistically different than the original values. Therefore the original FIS discharges were used for the current study.

Antelope Creek Tributaries at Hazen, ND

The 10-, 2-, 1-, and 0.2-percent chance peak discharges for the Upstream Hazen, West Hazen, and East Hazen Tributaries were estimated using USGS regression equations (Reference 28).

Antelope Creek Split (South Highway 200 Tributary)

The 10-, 2-, 1-, and 0.2-percent chance peak discharges along the Antelope Creek Split were estimated using USGS regression equations (Reference 28).

East Tributary at Beulah

For the original study of the flooding hazard along East Tributary, the 10-, 2-, 1-, and 0.2-percent chance peak discharges were developed from the Soil Conservation Service National Handbook (Reference 9).

Since the original study a flood control dam (Beulah Dam) was constructed in this watershed. In order to account for the dam's impact on peak flows, a HEC-HMS model was developed and was used to estimate the 10-, 2-, 1-, and 0.2-percent chance discharges.

North Tributary at Beulah

For the original study of the flooding hazard along North Tributary, the 10-, 2-, 1-, and 0.2-percent chance peak discharges were developed from the Soil Conservation Service National Handbook (Reference 9).

For the current study, the North Tributary was incorporated in the HEC-HMS model developed for the East Tributary at Beulah.

West Tributary at Beulah

For the original study of the flooding hazard along West Tributary, the 10-, 2-, 1-, and 0.2-percent chance peak discharges were developed from the Soil Conservation Service National Handbook (Reference 23).

The resulting peak flows are provided in Table 1.

Table 1, "Summary of Discharges"

| Flooding Source and Location | Drainage Area (sq. mi.) | Peak Discharges (cfs) 10-Percent-Annual-Chance | 2-Percent-Annual-Chance | 1-Percent-Annual-Chance | 0.2-Percent-Annual-Chance |
|---|---|---|---|---|---|
| Knife River | | | | | |
| At Hazen | 2,240 | 16,000 | 33,000 | 42,000 | 71,000 |
| At Beulah | 2,051 | 15,000 | 31,000 | 39,000 | 65,000 |
| Spring Creek | 549 | 4,900 | 9,000 | 11,800 | 17,200 |
| Antelope Creek | 114.9 | 1,600 | 3,500 | 4,800 | 5,900 |
| Upstream Hazen Tributary | 0.27 | 55 | 109 | 136 | 210 |
| West Hazen Tributary | 1.50 | 164 | 332 | 414 | 639 |

| | | | | | |
|---|---|---|---|---|---|
| East Hazen Tributary | 5.65 | 376 | 769 | 961 | 1,486 |
| Antelope Creek Split at Hazen | 1.51 | 175 | 351 | 437 | 672 |
| East Tributary at Beulah | | | | | |
| Above Beulah Dam | 3.35 | N/A[1] | N/A[1] | 740 | N/A[1] |
| Below Beulah Dam | 3.35 | N/A[1] | N/A[1] | 50 | N/A[1] |
| Above North Tributary Confluence | 4.35 | N/A[1] | N/A[1] | 360 | N/A[1] |
| Below North Tributary Confluence | 5.28 | 230 | 490 | 600 | 930 |
| At Mouth | 5.42 | 260 | 550 | 670 | 1050 |
| North Tributary at Beulah | | | | | |
| Above Asphalt Road | 0.64 | N/A[1] | N/A[1] | 370 | N/A[1] |
| Below Asphalt Road | 0.64 | N/A[1] | N/A[1] | 80 | N/A[1] |
| Above East Tributary Confluence | 0.93 | N/A[1] | N/A[1] | 270 | N/A[1] |
| West Tributary at Beulah | 2.10 | 500 | 820 | 970 | 1,500 |

[1] Not computed due to limited detail study.

## 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data Table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed, selected cross section locations are also shown on the FIRM.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Knife River

For the original study of the Knife River, water surface elevations for the 10-, 2-, 1-, and 0.2-percent chance peak discharges were derived using WSP-2, a step-backwater computer program developed by the Soil Conservation Service (Reference 12). Valley and channel cross section data were obtained from engineering field surveys supplemented by U.S. Bureau of Reclamation topographic maps (Reference 3). Bridges and culverts were surveyed to obtain elevation data and structural geometry. Roughness coefficients (Manning's 'n'

values) for the flood plain were obtained by trial and error to match gaging station data. Manning's 'n' values varied from 0.04 to 0.09 for the channel and from 0.05 to 0.20 for the flood plains. Starting elevations for the Knife River were taken at its confluence with the Missouri River (Reference 22).

For the reaches of the Knife River for which a Zone A refinement was completed as part of the current study, the water surface elevations corresponding to a 1-percent chance flood event were determined using HEC-RAS with cross sections cut from the USGS 30 meter DEM using HEC-GeoRAS (Reference 31).

Spring Creek

For the original study of Spring Creek, water surface elevations for the 10-, 2-, 1-, and 0.2-percent chance peak discharges were computed using a step-backwater method computer program (Reference 15). Cross sections were obtained from topographic maps at a scale of 1:4800, with a contour interval of 10 feet, prepared by the U.S. Bureau of Land Management and from field surveys (Reference 2). Channel roughness factors (Manning's 'n') for these computations were assigned on the basis of field inspection of flood plain areas. The roughness value for the main channel of Spring Creek was 0.040, and ranged from 0.050 to 0.080 for the flood plain. Starting water-surface elevations were determined by the slope-area method (Reference 21).

For the reaches of Spring Creek for which a Zone A refinement was completed as part of the current study, the water surface elevations corresponding to a 1-percent chance flood event were determined using HEC-RAS with cross sections cut from the USGS 30 meter DEM using HEC-GeoRAS.

Antelope Creek and Antelope Creek Tributaries at Hazen

For the detailed re-study along Antelope Creek and the Antelope Creek Tributaries performed as part of the current study, water surface elevations were developed using HEC-RAS. Cross section data came from field surveys and 2-foot contour data acquired in 2006 by the City of Hazen. Manning's 'n' values were estimated using engineering judgment and varied from 0.035 to 0.045 for the channel and from 0.08 to 0.10 for the overbank areas. Starting water surface elevations were established using normal depth.

For the reaches of Antelope Creek and the Antelope Creek Tributaries for which a Zone A refinement was completed as part of the current study, the water surface elevations corresponding to a 1-percent chance flood event were determined using HEC-RAS with cross sections cut from the USGS 30 meter DEM using HEC-GeoRAS.

Antelope Creek Split

For the detailed study along the Antelope Creek Split at Hazen performed as part of the current study, water surface elevations were developed using HEC-RAS. Cross section data came from field surveys and 2-foot contour data acquired in 2006 by the City of Hazen. Manning's 'n' values were estimated using engineering judgment and varied from 0.035 to 0.045 for the channel and were

0.08 for the overbank areas. Starting water surface elevations were established using normal depth.

East Tributary and North Tributary at Beulah

For the detailed re-study along East Tributary below the confluence with the North Tributary and the limited detail study along the North Tributary and the East Tributary above the confluence with the North Tributary, water surface elevations were developed using HEC-RAS. Cross section data came from field surveys and 2-foot contour data acquired in 2006 by the City of Beulah. Manning's 'n' values were estimated using engineering judgment and varied from 0.040 to 0.045 for the channel and from 0.060 to 0.065 for the overbank areas. Starting water surface elevations were established using normal depth.

West Tributary at Beulah

For the original study of the West Tributary, water surface elevations for the 10-, 2-, 1-, and 0.2-percent chance peak discharges were derived using WSP-2, a step-backwater computer program developed by the Soil Conservation Service (Reference 12). Valley and channel cross section data were obtained from engineering field surveys supplemented by U.S. Bureau of Reclamation topographic maps. (Reference 3). Bridges and culverts were surveyed to obtain elevation data and structural geometry. Roughness coefficients (Manning's 'n' values) for the flood plain were obtained by trial and error to match gaging station data. Manning's 'n' values varied from 0.04 to 0.09 for the channel and from 0.05 to 0.20 for the flood plains. Starting elevations for the West Tributary were taken at its confluence with the Missouri River (Reference 23).

For the reaches of West Tributary for which a Zone A refinement was completed as part of the current study, the water surface elevations corresponding to a 1-percent chance flood event were determined using HEC-RAS with cross sections cut from the USGS 30 meter DEM using HEC-GeoRAS.

## 3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD 29). With the finalization of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are being prepared using NAVD 88 as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to NAVD 88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD 29 and NAVD 88, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

The conversion factor for each stream studied by detailed methods is shown below in Table 2.

Table 2. Stream Conversion Factor

| Stream Name | Elevation (feet NAVD above NGVD) |
|---|---|
| Knife River | +1.3 |
| Spring Creek | +1.3 |
| Antelope Creek and Tributaries | +1.3 |
| Antelope Creek Split | +1.3 |
| East Tributary at Beulah | +1.3 |
| North Tributary at Beulah | +1.3 |
| West Tributary at Beulah | +1.3 |

## 4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance flood data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data Table and Summary of Stillwater Elevations Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

### 4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied

by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. For the original studies on the Knife River and West Tributary at Beulah, the boundaries between cross sections were field surveyed. For the current study, the floodplain for the Knife River at Hazen was redelineated using 2-foot contour data acquired by the City of Hazen in 2006. For the original study on Spring Creek, the boundaries between cross sections were interpolated using topographic maps at a scale of 1:4800, with a contour interval of 10 feet (Reference 2). For the current studies along Antelope Creek, the Antelope Creek Tributaries, Antelope Creek Split, North and East Tributaries at Beulah, the hydraulic model output was exported to a text file that was then imported into ArcView using HEC-GeoRAS. The floodplain boundaries were delineated using the 2-foot contour data acquired by the Cities of Beulah and Hazen in 2006 and HEC-GeoRAS. The boundaries were then hand checked and edited to ensure completeness. For the stream reaches that were studied by approximate methods as part of the current study, floodplain boundaries were delineated using the USGS 30M DEM and HEC-GeoRAS.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE); and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

## 4.2 Floodways

Encroachment of floodplains, such as structures and fill, reduces flood carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections (Table 3). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent-annual-chance flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

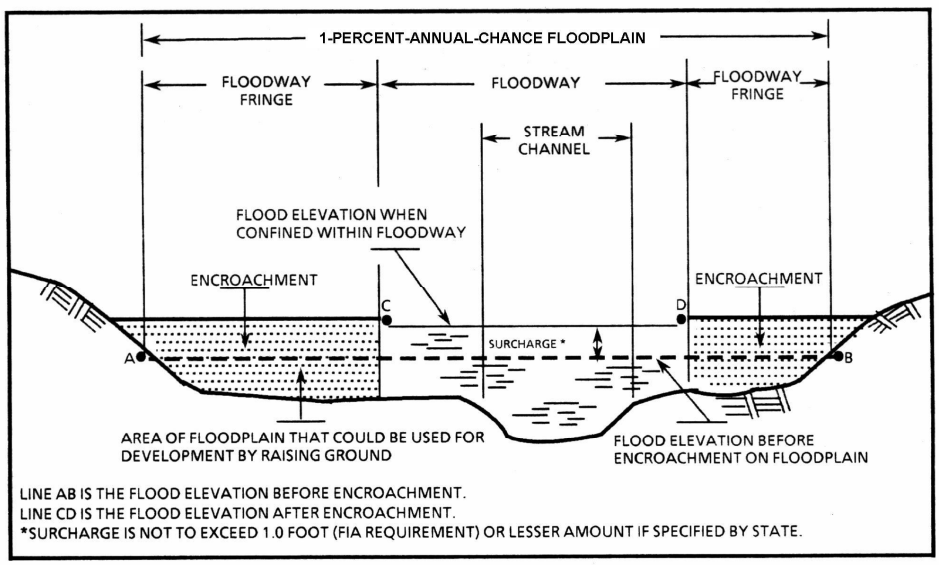


Figure 1, "Floodway Schematic"

No floodway was computed for the East Tributary above the confluence with the North Tributary and the North Tributary at Beulah because of the limited detail analysis.

## 5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NAVD) | | | |
| Knife River at Hazen | | | | | | | | |
| A | 21.73 | 1488 | 13,710 | 3.06 | 1737.4 | 1737.4 | 1738.4 | 1.0 |
| B | 22.61 | 1835 | 14,667 | 2.86 | 1738.9 | 1738.9 | 1739.9 | 1.0 |
| C | 23.93 | 3260[2] | 22,894 | 1.83 | 1739.8 | 1739.8 | 1740.8 | 1.0 |
| D | 25.1 | 656 | 5,758 | 7.29 | 1744.3 | 1744.3 | 1745.3 | 1.0 |
| Knife River at Beulah | | | | | | | | |
| A | 35.45 | 2063 | 14,310 | 2.65 | 1774.1 | 1774.1 | 1775.1 | 1.0 |
| B | 36.18 | 1358 | 13,230 | 2.86 | 1775.8 | 1775.8 | 1776.8 | 1.0 |
| C | 37.09 | 1790 | 11,480 | 3.30 | 1778.2 | 1778.2 | 1779.2 | 1.0 |
| D | 38.14 | 1468 | 11,748 | 3.23 | 1781.5 | 1781.5 | 1782.3 | 0.8 |
| E | 38.69 | 2603 | 14,062 | 2.70 | 1783.7 | 1783.7 | 1784.7 | 1.0 |

[1]Miles above Mouth
[2]Portion of Floodway Outside of Extraterritorial Limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND
AND INCORPORATED AREAS

**FLOODWAY DATA**

KNIFE RIVER

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | DIFFERENCE |
| | | | | | (FEET NAVD) | | | |
| Spring Creek | | | | | | | | |
| A | 11.64 | 381 | 2,386 | 4.9 | 1829.4 | 1829.4 | 1828.4 | 1.0 |
| B | 12.69 | 190 | 1,859 | 6.4 | 1836.9 | 1836.9 | 1835.9 | 1.0 |
| C | 13.37 | 138 | 1,814 | 6.5 | 1839.3 | 1839.3 | 1838.3 | 1.0 |
| D | 13.40 | 352 | 3,380 | 3.5 | 1841.6 | 1841.6 | 1840.6 | 1.0 |
| E | 14.16 | 397 | 3,104 | 3.8 | 1844.6 | 1844.6 | 1843.6 | 1.0 |
| F | 14.22 | 344 | 3,223 | 3.7 | 1845.1 | 1845.1 | 1844.1 | 1.0 |
| G | 14.23 | 221 | 3,765 | 3.1 | 1845.7 | 1845.7 | 1844.7 | 1.0 |
| H | 14.44 | 208 | 2,309 | 5.1 | 1846.1 | 1846.1 | 1845.1 | 1.0 |
| I | 14.68 | 562 | 3,920 | 3.0 | 1847.3 | 1847.3 | 1846.3 | 1.0 |
| J | 15.12 | 509 | 3,614 | 3.3 | 1848.4 | 1848.4 | 1847.4 | 1.0 |

[1]Miles above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND
AND INCORPORATED AREAS

**FLOODWAY DATA**

SPRING CREEK AT ZAP, ND

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NAVD) | | | |
| Antelope Creek | | | | | | | | |
| A | 7,807 | 157 | 1,308 | 3.7 | 1737.5 | 1737.5 | 1738.5 | 1.0 |
| B | 10,444 | 300 | 1,348 | 3.6 | 1739.9 | 1739.9 | 1740.8 | 0.9 |
| C | 14,766 | 54 | 684 | 7.2 | 1745.0 | 1745.0 | 1745.1 | 0.1 |
| D | 16,661 | 310 | 2,330 | 2.1 | 1747.1 | 1747.1 | 1747.3 | 0.2 |
| E | 16,961 | 225 | 1,991 | 2.4 | 1747.3 | 1747.3 | 1747.4 | 0.1 |
| F | 18,365 | 102 | 1,125 | 4.3 | 1749.6 | 1749.6 | 1749.7 | 0.1 |
| G | 18,978 | 170 | 1,796 | 2.7 | 1749.8 | 1749.8 | 1750.6 | 0.8 |
| H | 19,700 | 139 | 1,559 | 3.1 | 1750.0 | 1750.0 | 1750.8 | 0.8 |
| I | 20,654 | 90 | 832 | 5.8 | 1750.3 | 1750.3 | 1751.2 | 0.9 |
| J | 21,288 | 84 | 828 | 5.8 | 1751.0 | 1751.0 | 1751.9 | 0.9 |
| K | 22,778 | 550 | 3,061 | 1.6 | 1752.7 | 1752.7 | 1753.5 | 0.8 |
| L | 23,098 | 750 | 4,225 | 1.1 | 1752.8 | 1752.8 | 1753.7 | 0.9 |
| M | 25,916 | 570 | 3,008 | 1.6 | 1753.3 | 1753.3 | 1754.3 | 1.0 |
| N | 26,247 | 550 | 3,359 | 1.4 | 1753.6 | 1753.6 | 1754.5 | 0.9 |
| O | 28,418 | 123 | 880 | 5.5 | 1755.5 | 1755.5 | 1755.8 | 0.3 |
| P | 28,565 | 272 | 1,546 | 3.1 | 1756.2 | 1756.2 | 1756.4 | 0.2 |
| Q | 28,693 | 144 | 1,043 | 4.6 | 1756.2 | 1756.2 | 1756.4 | 0.2 |
| R | 28,978 | 104 | 924 | 5.2 | 1756.5 | 1756.5 | 1756.7 | 0.2 |
| S | 30,272 | 140 | 1,044 | 4.6 | 1758.3 | 1758.3 | 1758.7 | 0.4 |

[1]Feet above confluence with Knife River.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND
AND INCORPORATED AREAS

**FLOODWAY DATA**

ANTELOPE CREEK AT HAZEN, ND

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NAVD) | | | |
| East Hazen Tributary | | | | | | | | |
| A | 312 | 76 | 712 | 1.4 | 1736.5 | 1736.0[2] | 1737.0 | 1.0 |
| B | 1,473 | 55 | 140 | 6.9 | 1736.6 | 1736.6 | 1736.9 | 0.3 |
| West Hazen Tributary | | | | | | | | |
| A | 175 | 28 | 155 | 2.7 | 1749.8 | 1749.8 | 1750.5 | 0.7 |
| B | 308 | 58 | 234 | 1.8 | 1749.9 | 1749.9 | 1750.6 | 0.7 |
| C | 732 | 37 | 58 | 7.1 | 1753.7 | 1753.7 | 1753.7 | 0.0 |
| D | 1,209 | 30 | 65 | 8.5 | 1760.8 | 1760.8 | 1760.8 | 0.0 |
| E | 1,323 | 43 | 196 | 2.1 | 1763.7 | 1763.7 | 1764.4 | 0.7 |
| F | 1,582 | 50 | 79 | 5.3 | 1764.1 | 1764.1 | 1764.5 | 0.4 |
| Upstream Hazen Tributary | | | | | | | | |
| A | 97 | 29 | 319 | 0.4 | 1753.5 | 1753.5 | 1754.5 | 1.0 |
| B | 1,016 | 185 | 665 | 0.2 | 1753.5 | 1753.5 | 1754.5 | 1.0 |

[1]Feet above confluence with Antelope Creek.
[2]Elevation computed without consideration of backwater effects from Knife River

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND
AND INCORPORATED AREAS

## FLOODWAY DATA

EAST HAZEN TRIBUTARY TO ANTELOPE CREEK (REACH #6), WEST HAZEN TRIBUTARY TO ANTELOPE CREEK (REACH #4), AND UPSTREAM HAZEN TRIBUTARY TO ANTELOPE CREEK (REACH #2)

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NAVD) | | | |
| Antelope Creek Split | | | | | | | | |
| A | 3,026 | 72 | 161 | 2.7 | 1743.3 | 1740.4[2] | 1740.4 | 0.0 |
| B | 3,226 | 41 | 74 | 5.9 | 1743.3 | 1740.8[2] | 1740.8 | 0.0 |
| C | 3,568 | 73 | 201 | 2.2 | 1744.8 | 1744.8 | 1745.8 | 1.0 |
| D | 3,941 | 103 | 506 | 0.9 | 1745.1 | 1745.1 | 1746.0 | 0.9 |
| E | 4,226 | 55 | 262 | 1.7 | 1745.1 | 1745.1 | 1746.0 | 0.9 |
| F | 5,101 | 69 | 170 | 2.6 | 1746.0 | 1746.0 | 1746.6 | 0.6 |
| G | 5,530 | 45 | 143 | 3.1 | 1747.1 | 1747.1 | 1747.4 | 0.3 |
| H | 5,853 | 65 | 188 | 2.3 | 1747.6 | 1747.6 | 1747.9 | 0.3 |
| I | 6,315 | 115 | 606 | 0.7 | 1751.9 | 1751.9 | 1752.1 | 0.2 |
| J | 6,715 | 46 | 342 | 1.3 | 1751.9 | 1751.9 | 1752.2 | 0.3 |
| K | 7,067 | 122 | 672 | 0.7 | 1752.0 | 1752.0 | 1752.3 | 0.3 |
| L | 7,359 | 71 | 351 | 1.2 | 1752.5 | 1752.5 | 1753.4 | 0.9 |
| M | 7,659 | 108 | 418 | 1.0 | 1752.5 | 1752.5 | 1753.5 | 1.0 |
| N | 8,024 | 100 | 436 | 1.0 | 1754.2 | 1754.2 | 1755.2 | 1.0 |
| O | 8,264 | 90 | 382 | 1.1 | 1754.3 | 1754.3 | 1755.3 | 1.0 |
| P | 8,826 | 81 | 396 | 1.1 | 1757.8 | 1757.8 | 1758.1 | 0.3 |
| Q | 8,881 | 81 | 397 | 1.1 | 1757.8 | 1757.8 | 1758.1 | 0.3 |
| R | 8,976 | 107 | 741 | 0.6 | 1758.0 | 1758.0 | 1758.3 | 0.3 |

[1]Feet above confluence with Knife River.
[2]Elevation computed without consideration of backwater effects from Knife River.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND
AND INCORPORATED AREAS

**FLOODWAY DATA**

ANTELOPE CREEK SPLIT AT HAZEN, ND

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NAVD) | | | |
| East Tributary at Beulah, ND | | | | | | | | |
| A | 800 | 34 | 97 | 6.9 | 1778.2 | 1766.6[2] | 1766.6 | 0.0 |
| B | 1776 | 42 | 140 | 5.1 | 1778.2 | 1777.9[2] | 1778.3 | 0.4 |
| C | 1992 | 49 | 144 | 4.6 | 1779.3 | 1779.3 | 1779.4 | 0.1 |
| D | 2113 | 62 | 265 | 2.5 | 1780.9 | 1780.9 | 1780.9 | 0.0 |
| E | 2216 | 40 | 134 | 8.8 | 1780.5 | 1780.5 | 1780.6 | 0.0 |
| F | 2333 | 58 | 157 | 5.3 | 1782.1 | 1782.1 | 1782.1 | 0.0 |
| G | 2658 | 43 | 81 | 7.9 | 1783.3 | 1783.3 | 1783.3 | 0.0 |
| H | 3351 | 32 | 84 | 8.6 | 1791.5 | 1791.5 | 1791.8 | 0.3 |
| I | 3448 | 43 | 171 | 5.8 | 1794.8 | 1794.8 | 1794.9 | 0.1 |
| J | 3785 | 30 | 95 | 8.4 | 1795.8 | 1795.8 | 1795.9 | 0.1 |
| K | 3885 | 38 | 180 | 3.9 | 1797.0 | 1797.0 | 1797.9 | 0.9 |
| West Tributary at Beulah, ND | | | | | | | | |
| A | 4,150 | 233 | 281 | 3.64 | 1793.3 | 1793.3 | 1794.3 | 1.0 |
| B | 5,570 | 57 | 155 | 6.62 | 1804.6 | 1804.6 | 1805.6 | 1.0 |
| C | 6,262 | 102 | 363 | 2.83 | 1810.8 | 1810.8 | 1811.8 | 1.0 |

[1]Feet above confluence with Knife River.
[2]Elevation computed without consideration of Backwater effects from Knife River.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND
AND INCORPORATED AREAS

## FLOODWAY DATA

EAST TRIBUTARY TO KNIFE RIVER AND WEST TRIBUTARY TO KNIFE RIVER AT BEULAH, ND

Zone A

Zone A is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFE's or base flood depths are shown within this zone.

Zone AE

Zone AE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole –foot BFE's derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 ft., areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 sq. mi., and areas protected from the 1-percent-annual-chance flood by levees. No BFE's or depths are shown within this zone.

## 6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of Mercer County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the county identified as floodprone. The countywide FIRM also includes flood hazard information that was presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community are presented in Table 4, Community Map History.

## 7.0 OTHER STUDIES

An FIS report was published for the City of Zap in January, 1979. An FIS report was published for the City of Beulah in April 1977 and was superseded by an FIS dated

March, 1982. An FIS report was published for the City of Hazen in March, 1977 and was superseded by an FIS dated January, 1982.

No previous studies have been prepared for the unincorporated areas of Mercer County or for the communities of Golden Valley, Pick City or Stanton or for the Three Affiliated Tribes Fort Berthold Reservation.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

| COMMUNITY NAME | INITIAL IDENTIFICATION | FLOOD HAZARD BOUNDARY MAP REVISION DATE(S) | FLOOD INSURANCE RATE MAP EFFECTIVE DATE | FLOOD INSURANCE RATE MAP REVISION DATE(S) |
|---|---|---|---|---|
| Beulah | November 23, 1973 | N/A | March 2, 1982 | DFIRM Effective Date |
| Golden Valley | N/A | N/A | N/A | DFIRM Effective Date |
| Hazen | November 23, 1973 | N/A | October 18, 1983 | DFIRM Effective Date |
| Pick City | N/A | N/A | N/A | DFIRM Effective Date |
| Stanton | April 2, 1976 | N/A | November 7, 1978 | DFIRM Effective Date |
| Zap | December 27, 1974 | N/A | July 16, 1979 | DFIRM Effective Date |
| Three Affiliated Tribes of Fort Berthold Reservation | August 23, 2000 | N/A | N/A | DFIRM Effective Date |
| Unicorporated Areas | April 7, 1981 | N/A | June 1, 1998 | DFIRM Effective Date |

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**BARNES COUNTY, ND**
**AND INCORPORATED AREAS**

**COMMUNITY MAP HISTORY**

## 8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Federal Insurance and Mitigation Division, Denver Federal Center, Building 710, P.O. Box 25267, Denver, Colorado 80225-0267.

## 9.0 BIBLIOGRAPHY AND REFERENCES


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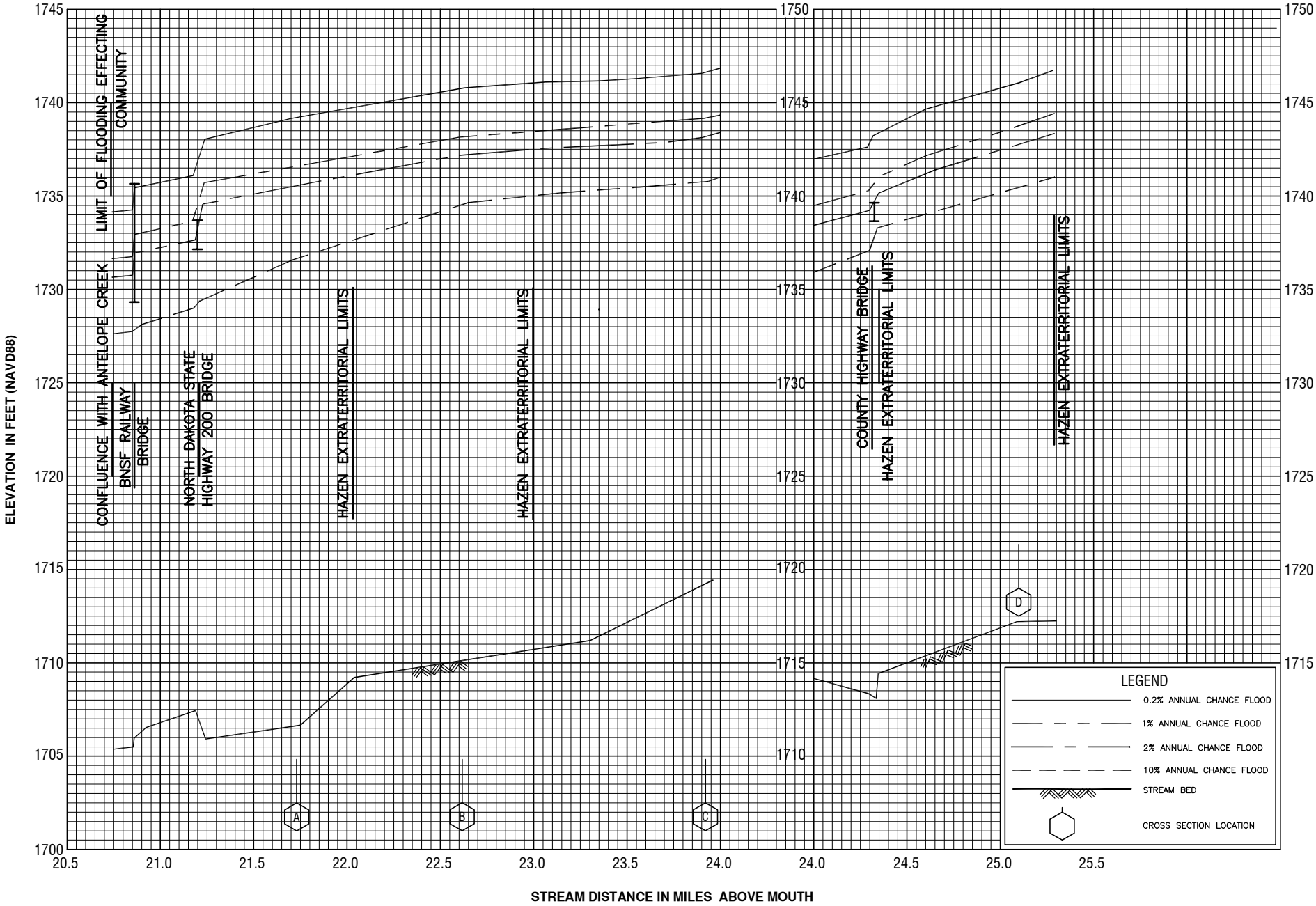


# FLOOD PROFILES

## KNIFE RIVER AT HAZEN, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MERCER COUNTY, ND**

AND INCORPORATED AREAS

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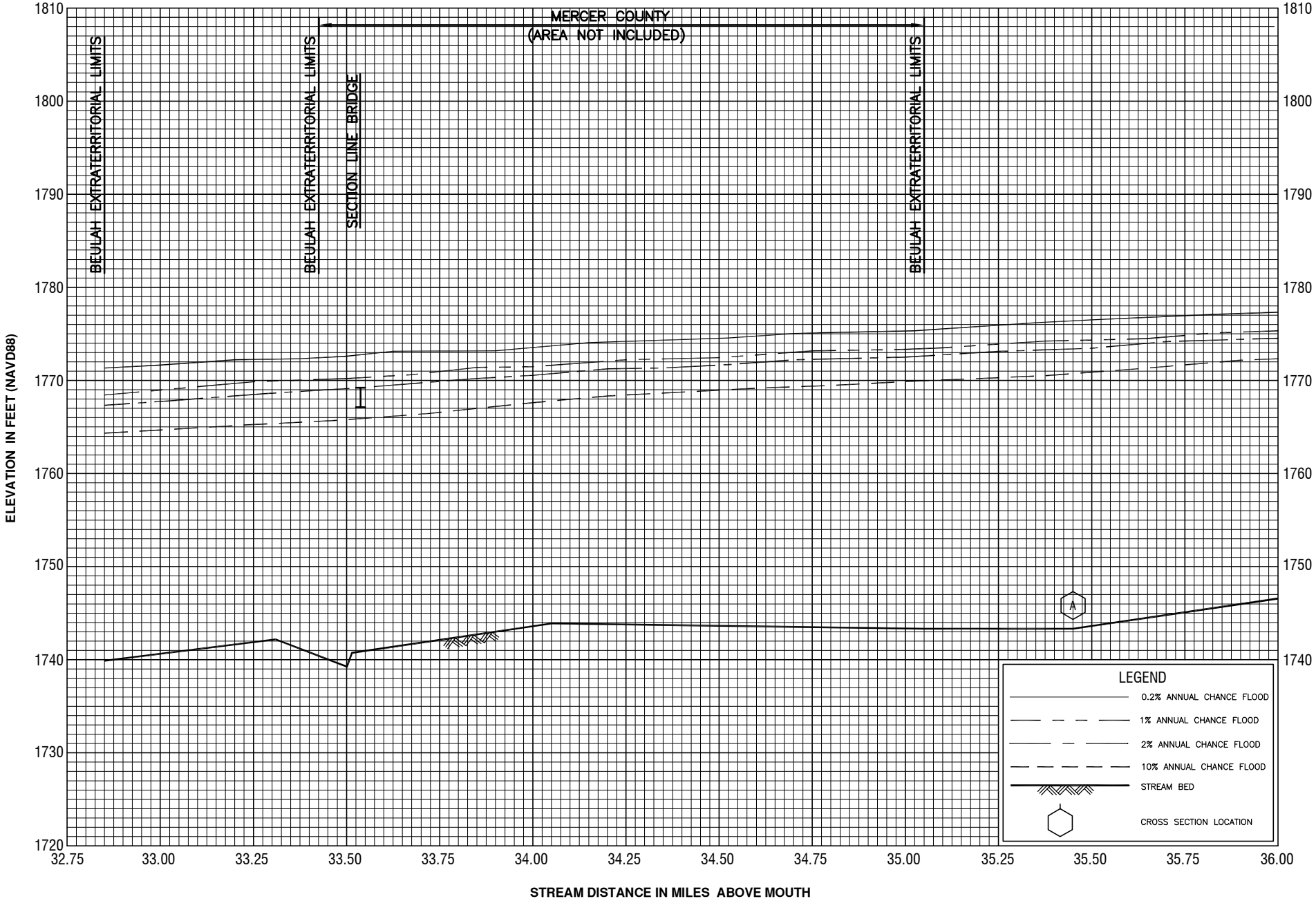
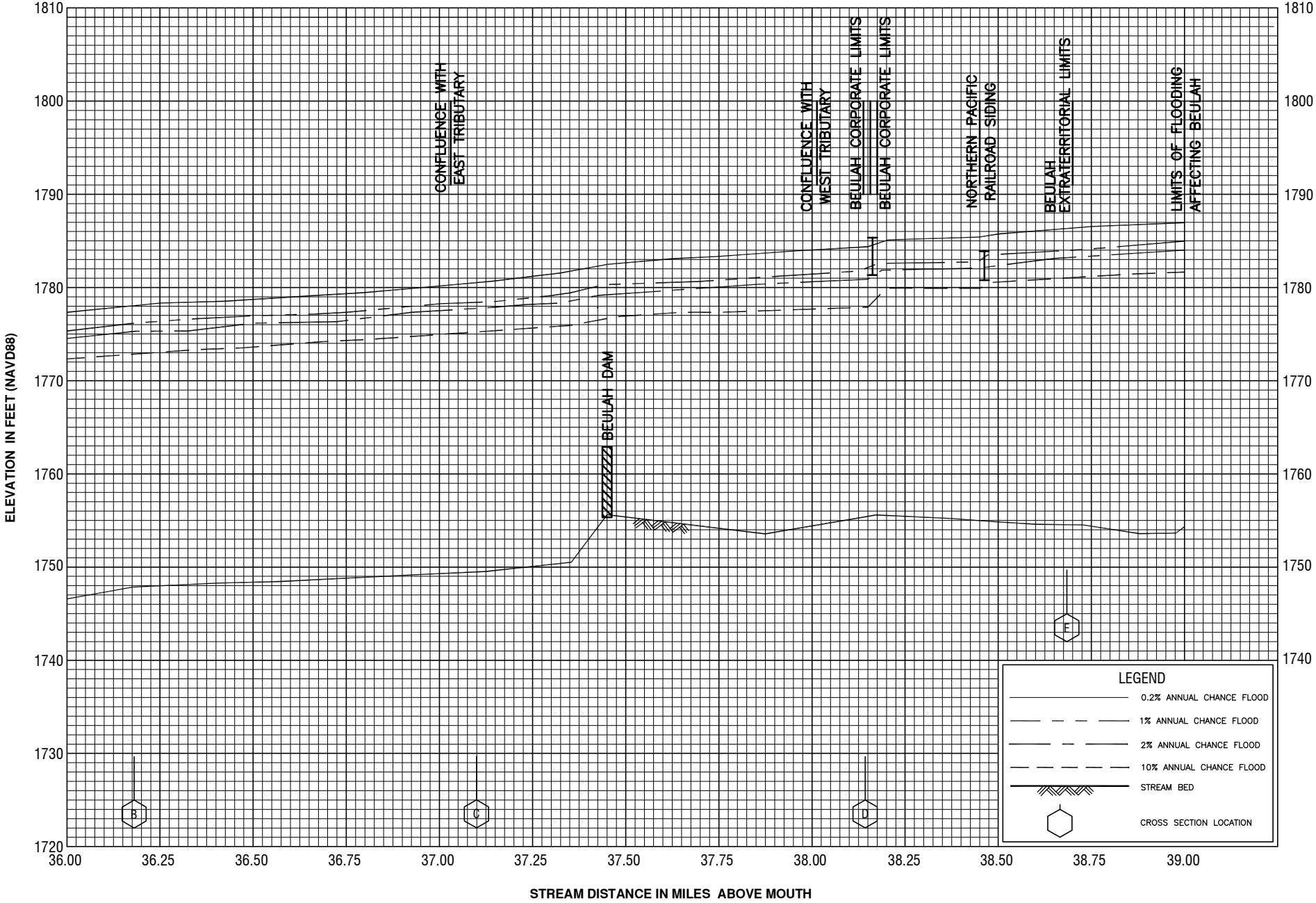



# FLOOD PROFILES

## KNIFE RIVER AT BEULAH, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MERCER COUNTY, ND**
**AND INCORPORATED AREAS**




# FLOOD PROFILES

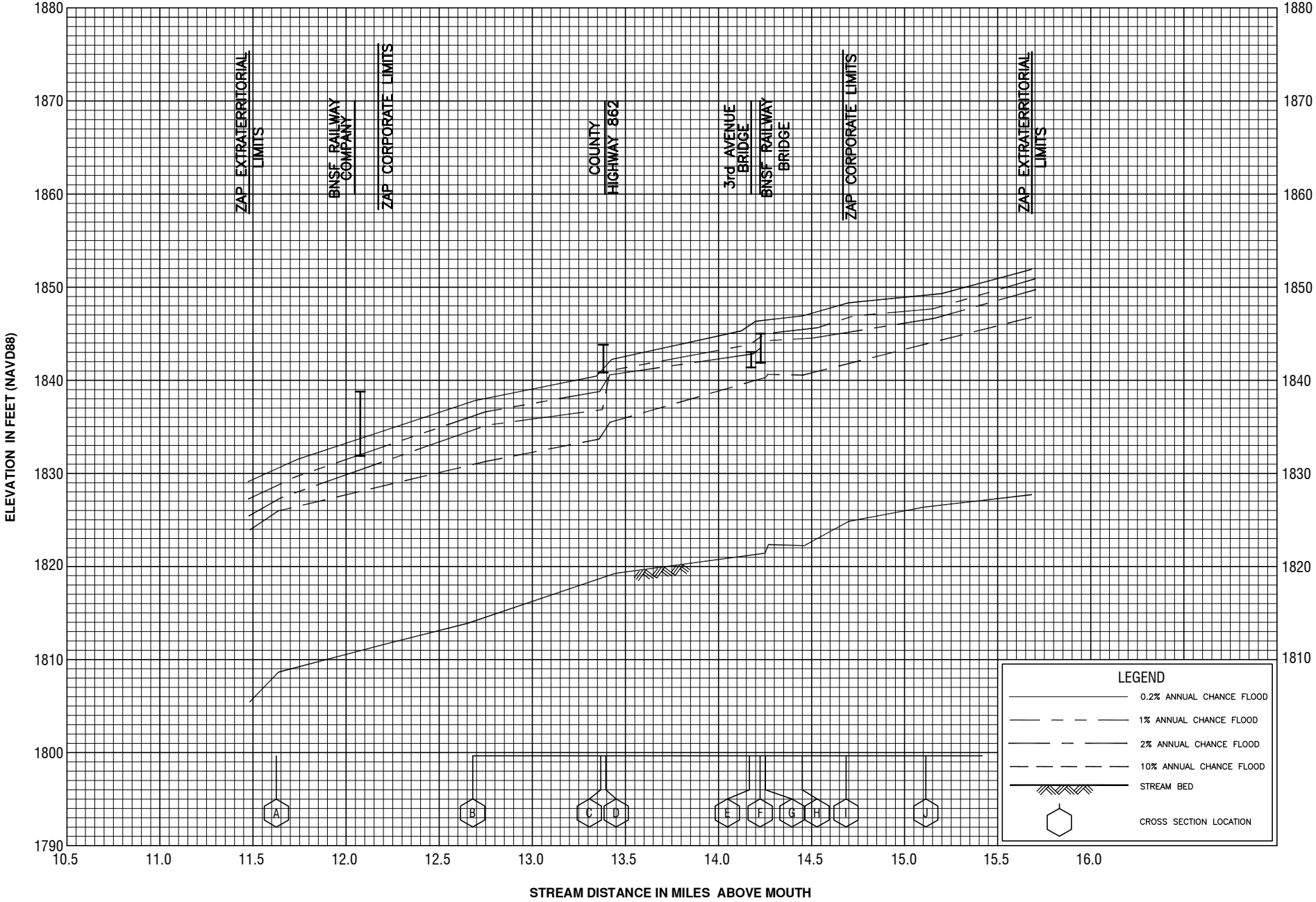
## KNIFE RIVER AT BEULAH, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MERCER COUNTY, ND**

AND INCORPORATED AREAS

03P




# FLOOD PROFILES

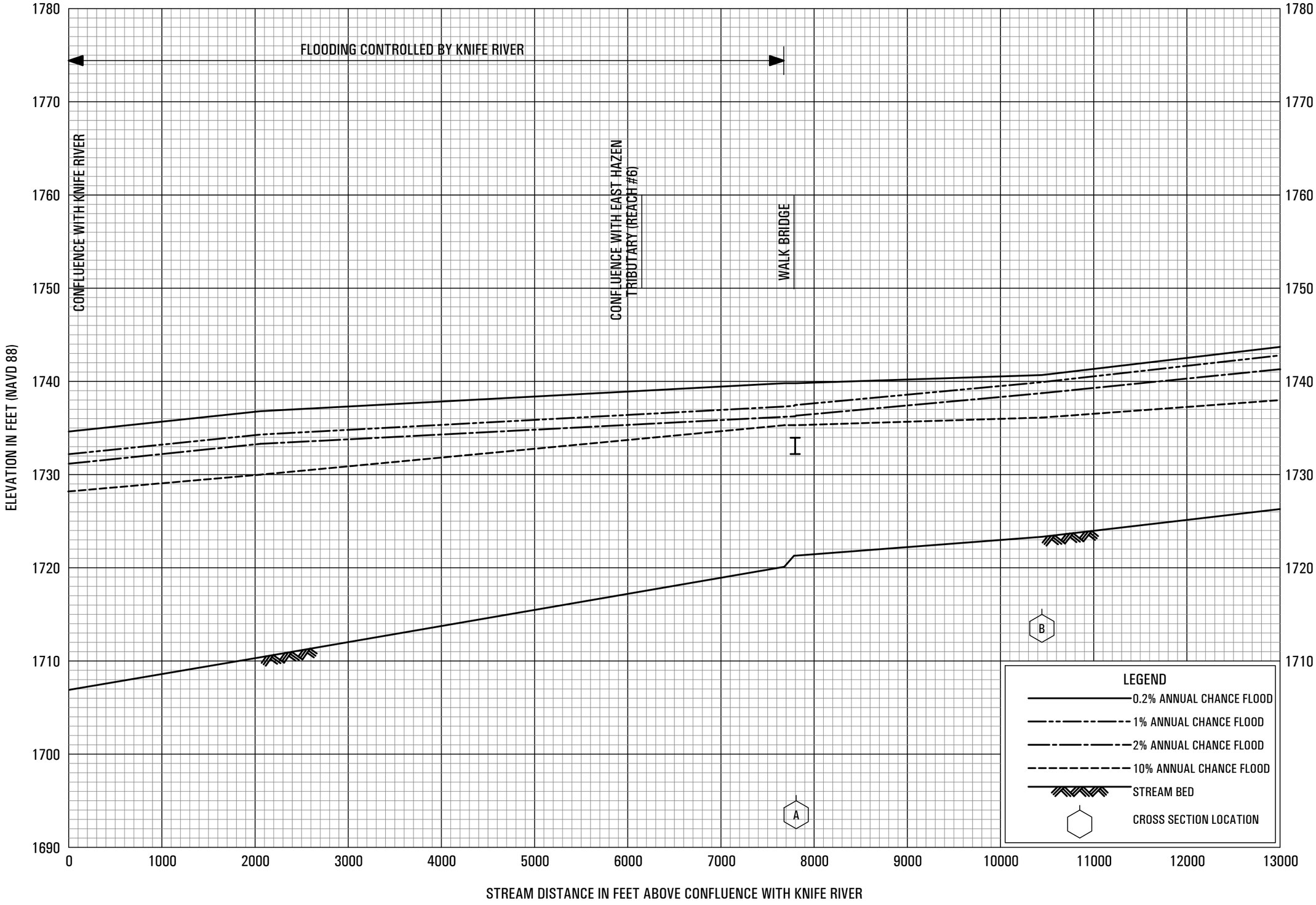
## SPRING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MERCER COUNTY, ND**

AND INCORPORATED AREAS

04P




FLOOD PROFILES

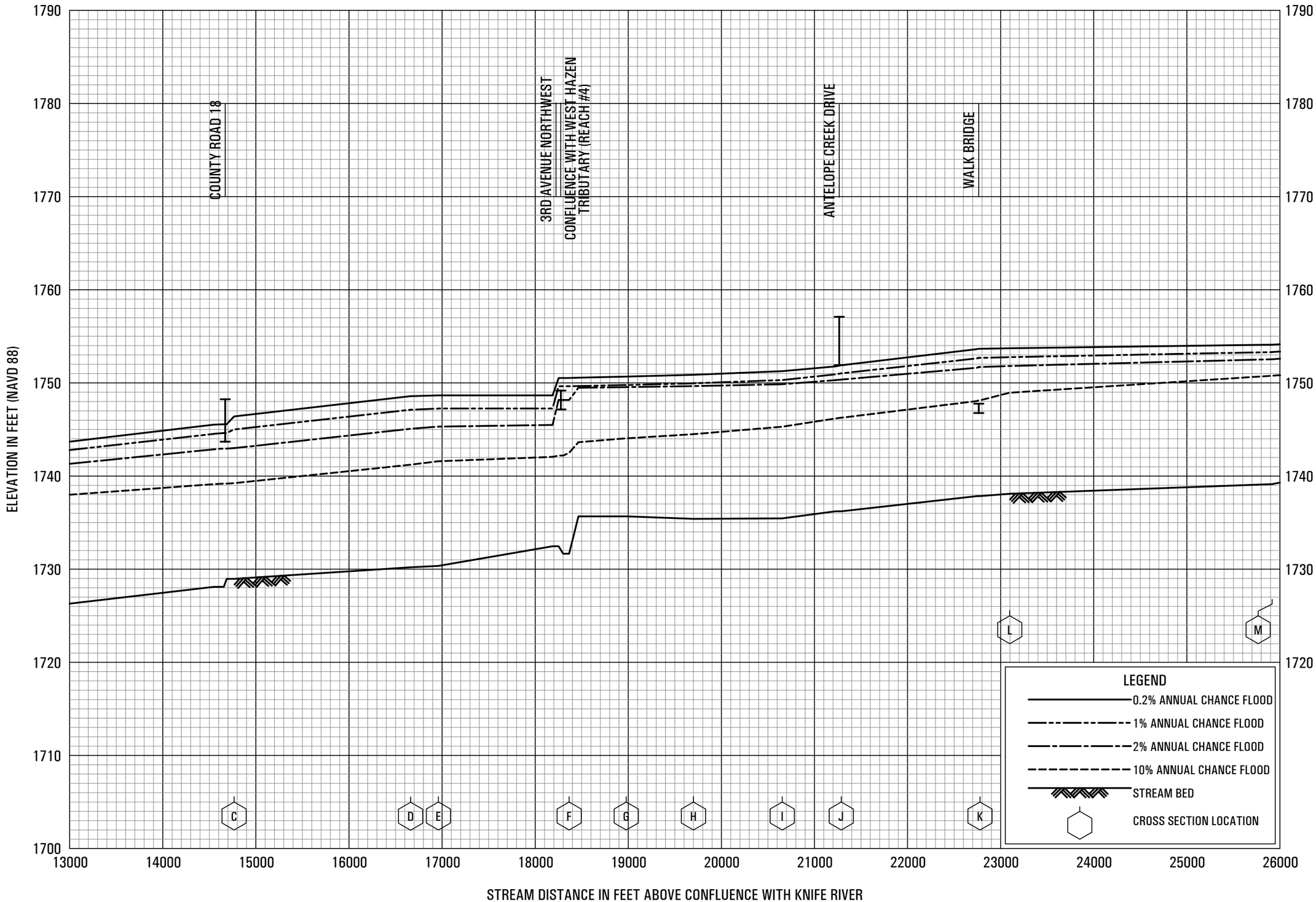
ANTELOPE CREEK AT HAZEN, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS

05P




FLOOD PROFILES

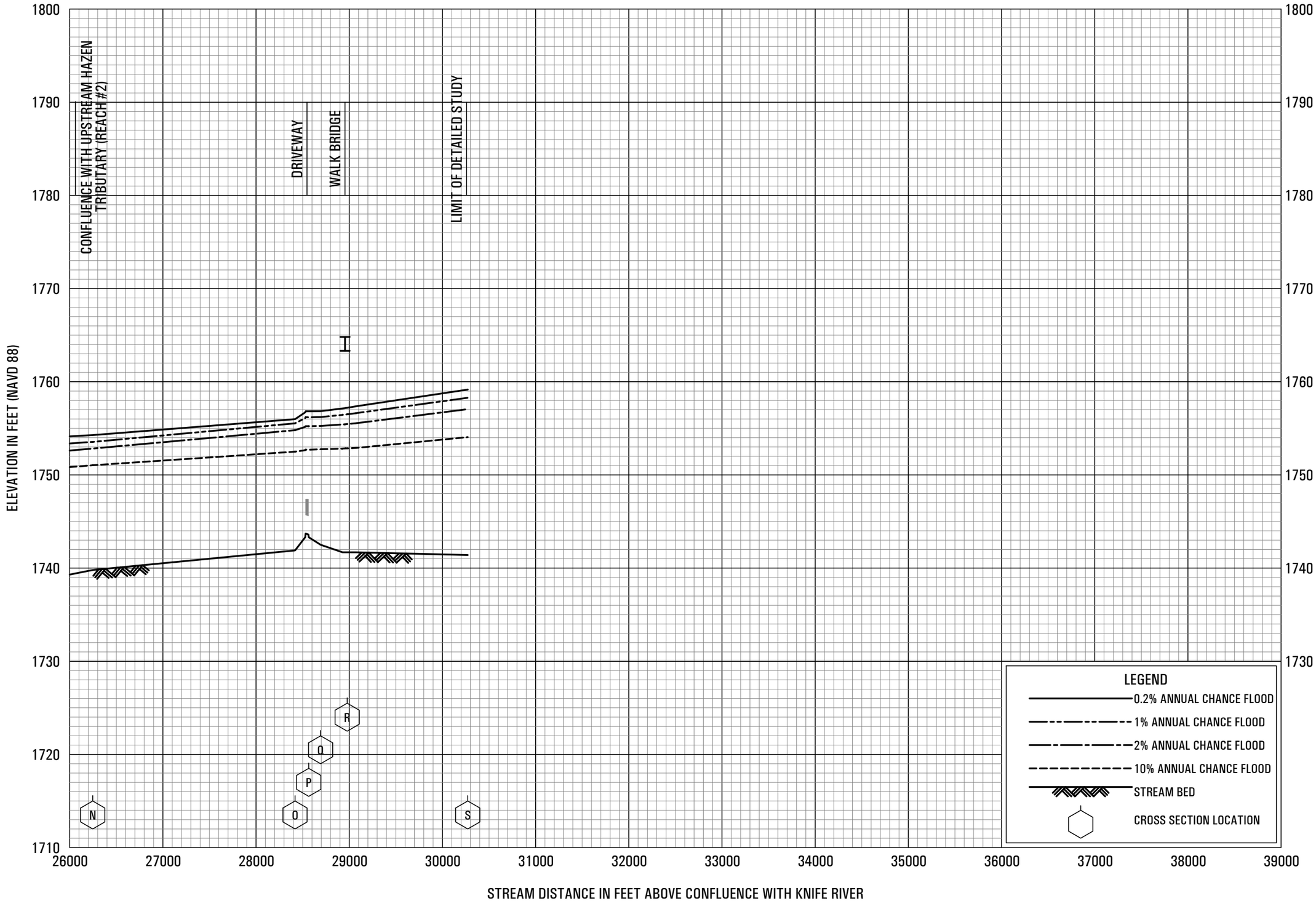
ANTELOPE CREEK AT HAZEN, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS

06P




FLOOD PROFILES

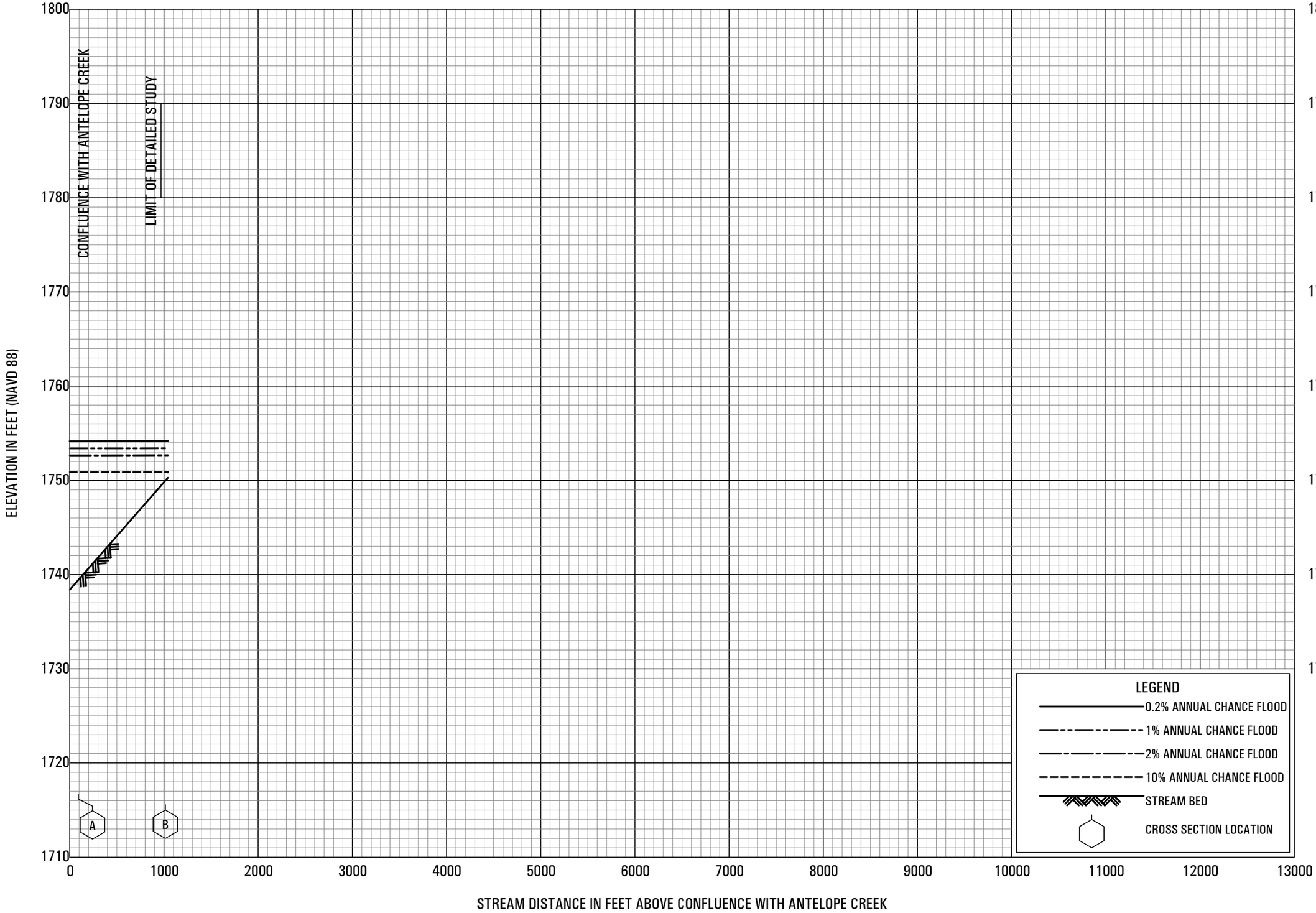
ANTELOPE CREEK AT HAZEN, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS

07P




FLOOD PROFILES

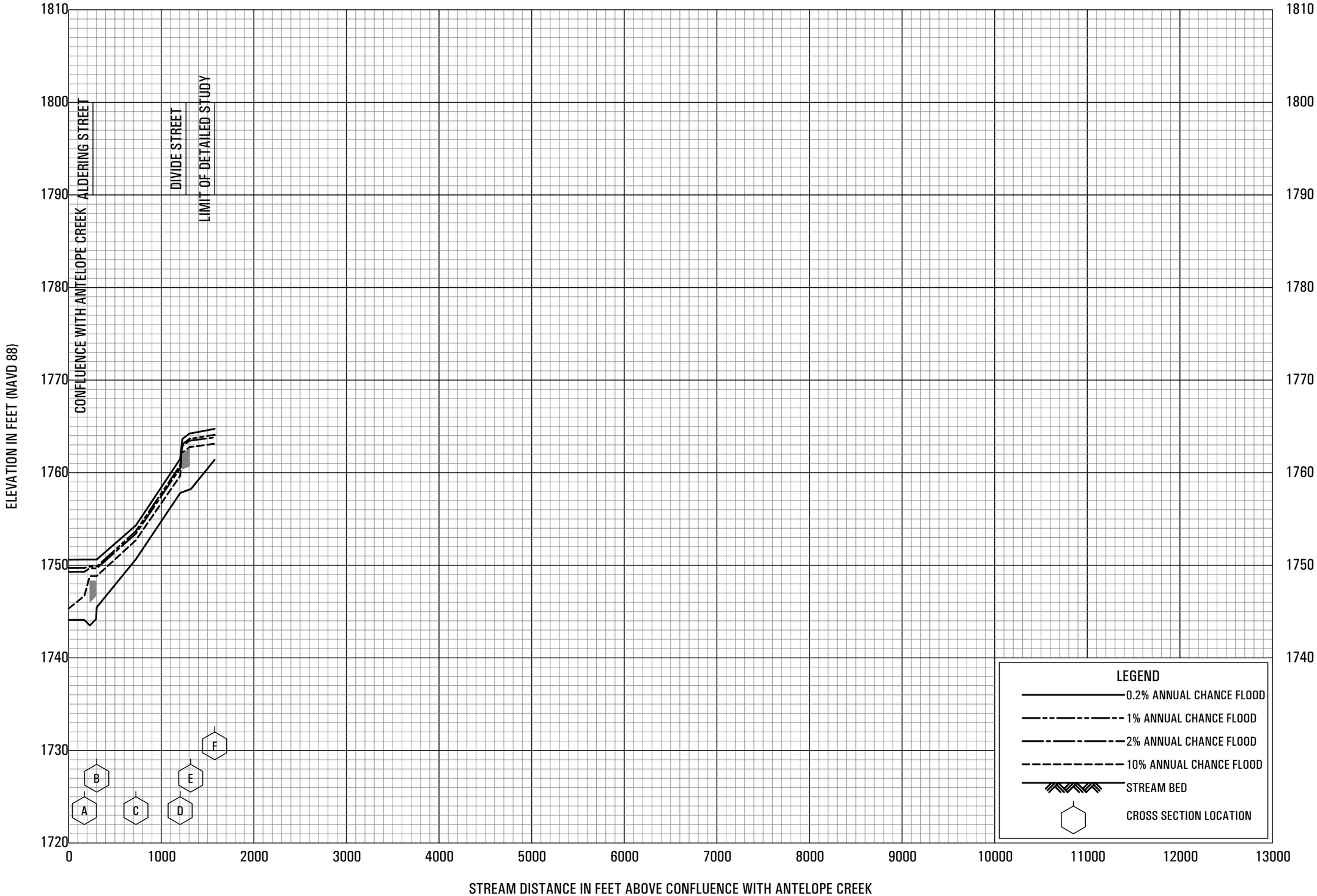
UPSTREAM HAZEN TRIBUTARY (REACH #2) AT HAZEN, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS

08P




FLOOD PROFILES

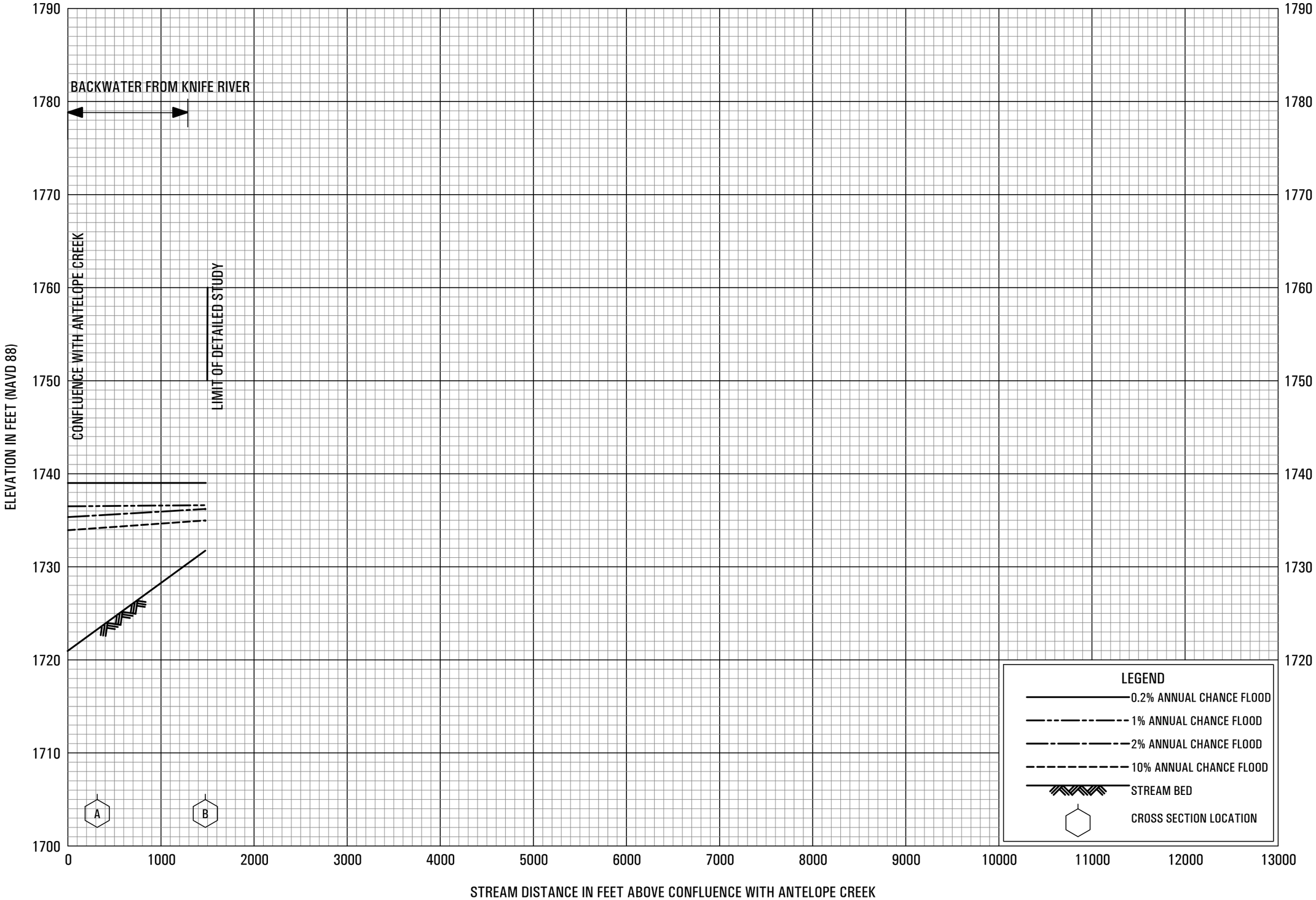
WEST HAZEN TRIBUTARY (REACH #4) AT HAZEN, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS

09P



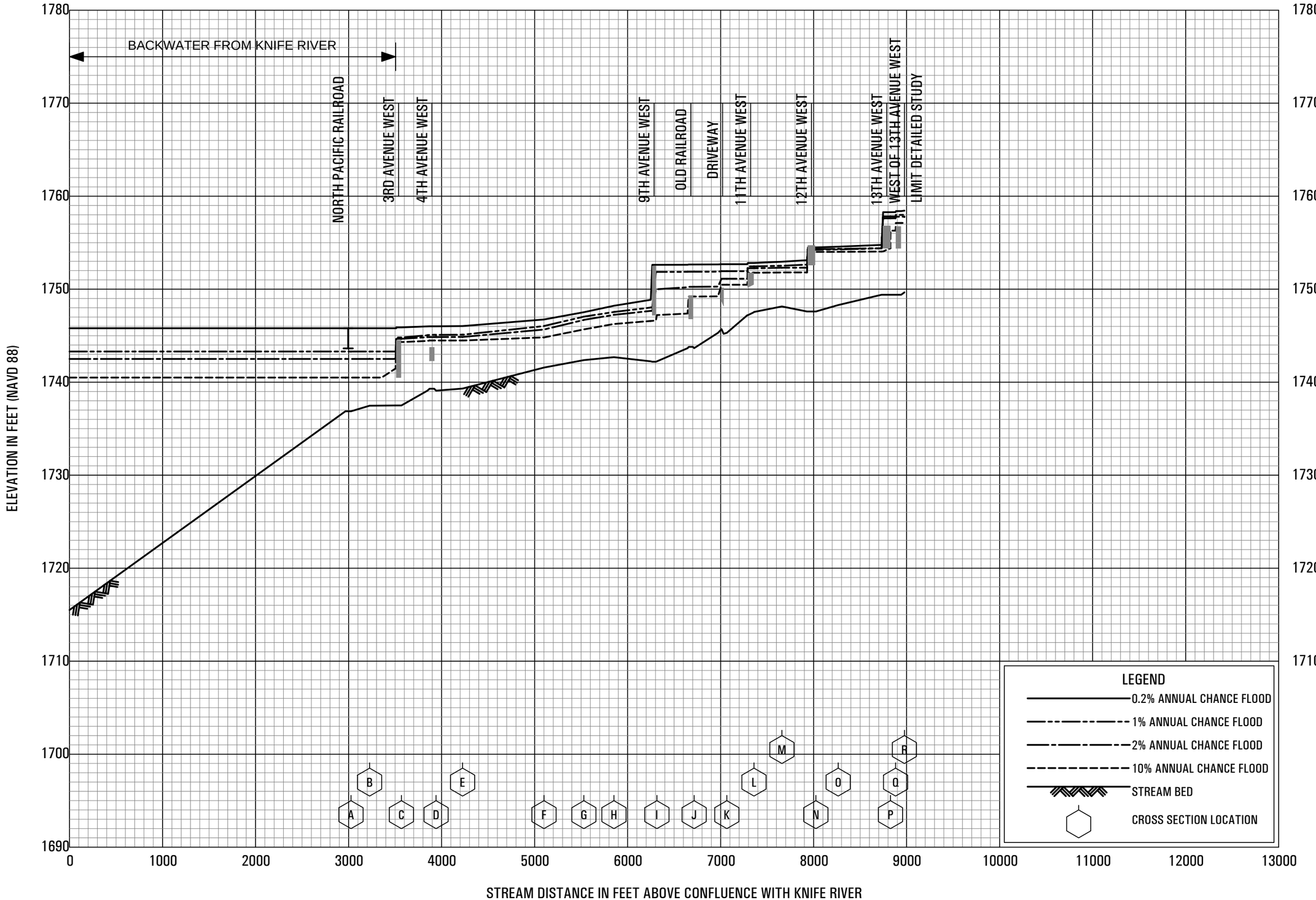

FLOOD PROFILES

EAST HAZEN TRIBUTARY (REACH #6) AT HAZEN, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS



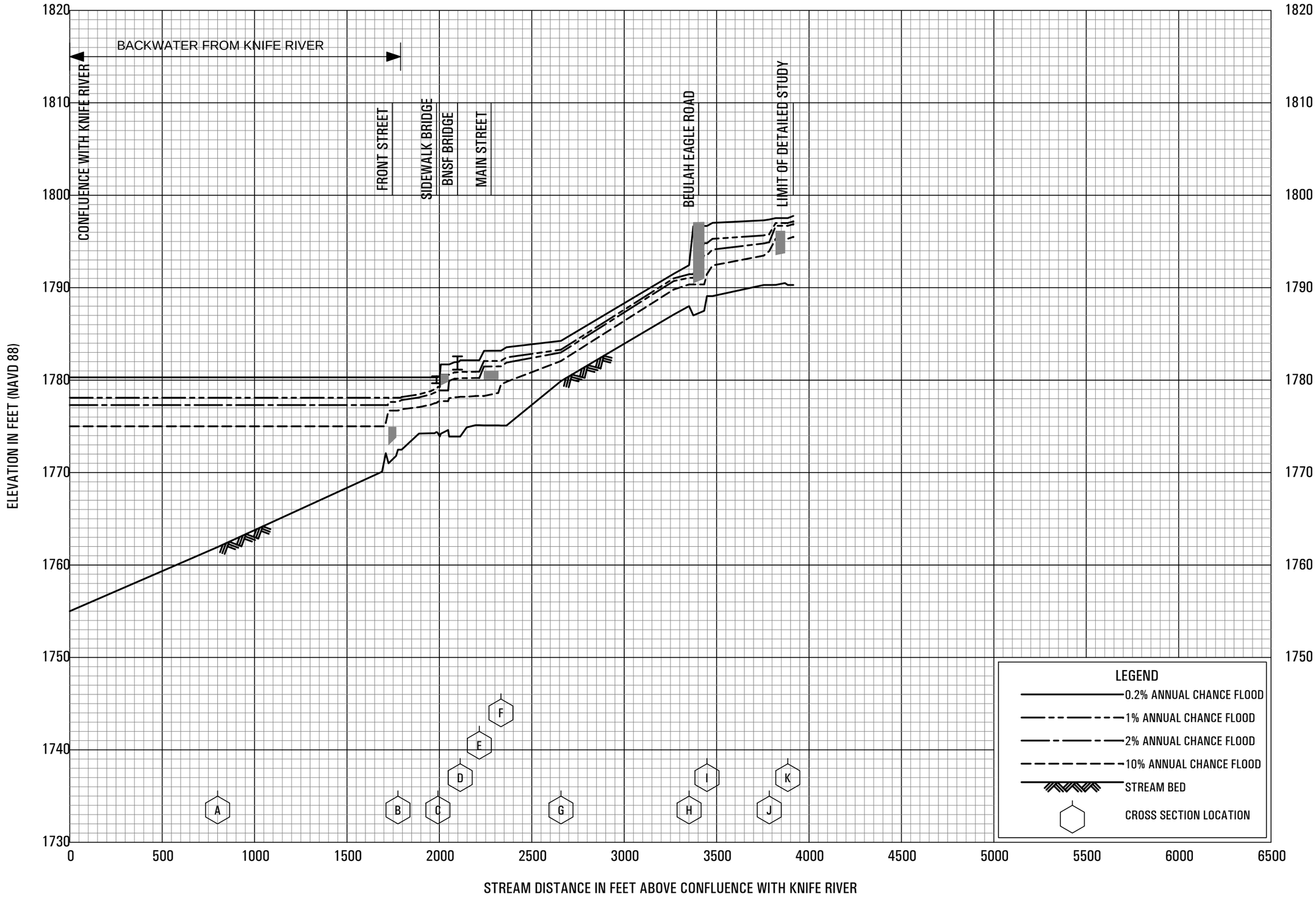

FLOOD PROFILES

ANTELOPE CREEK SPLIT AT HAZEN, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS



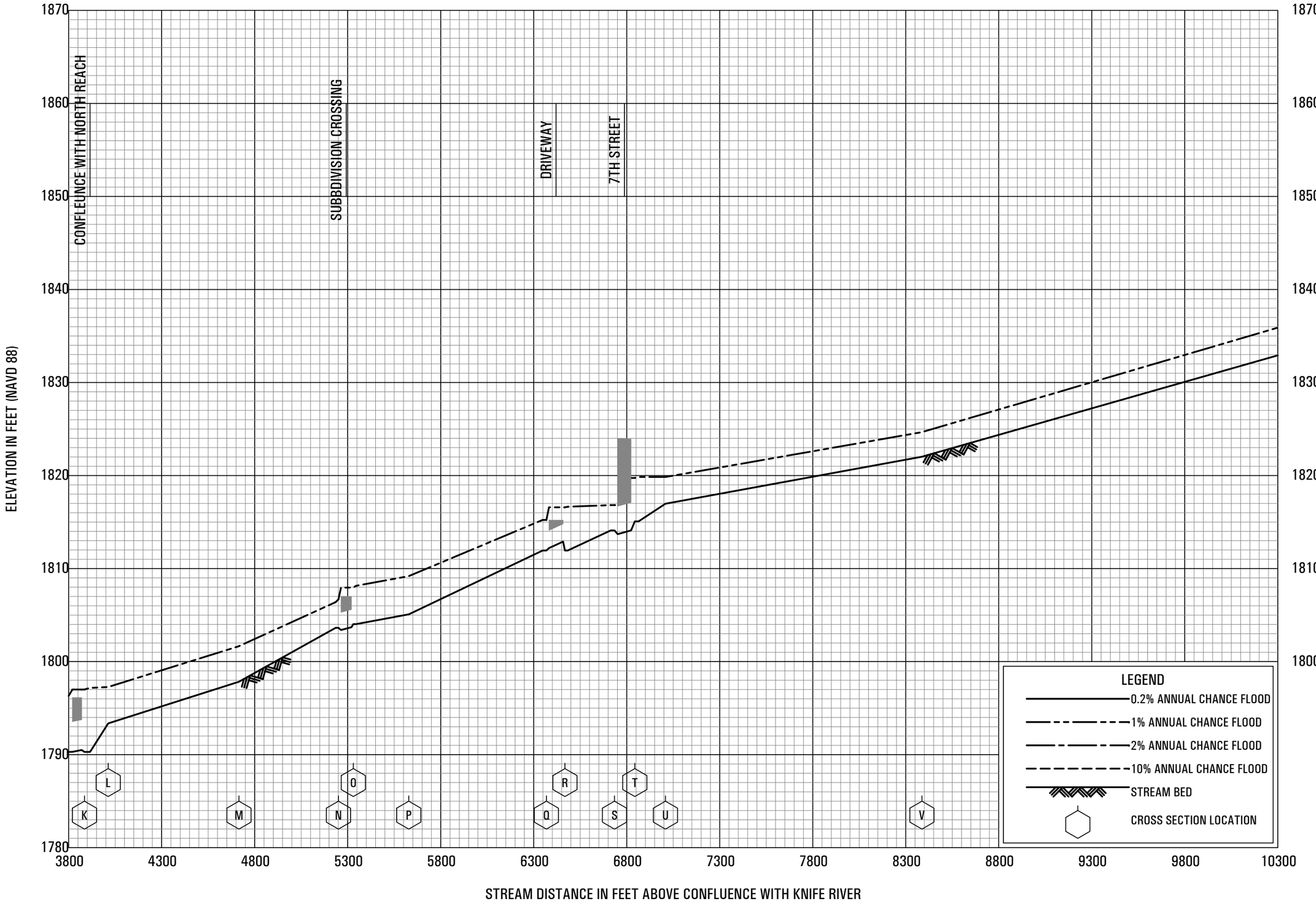

FLOOD PROFILES

EAST TRIBUTARY REACH #2 AT BEULAH, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS



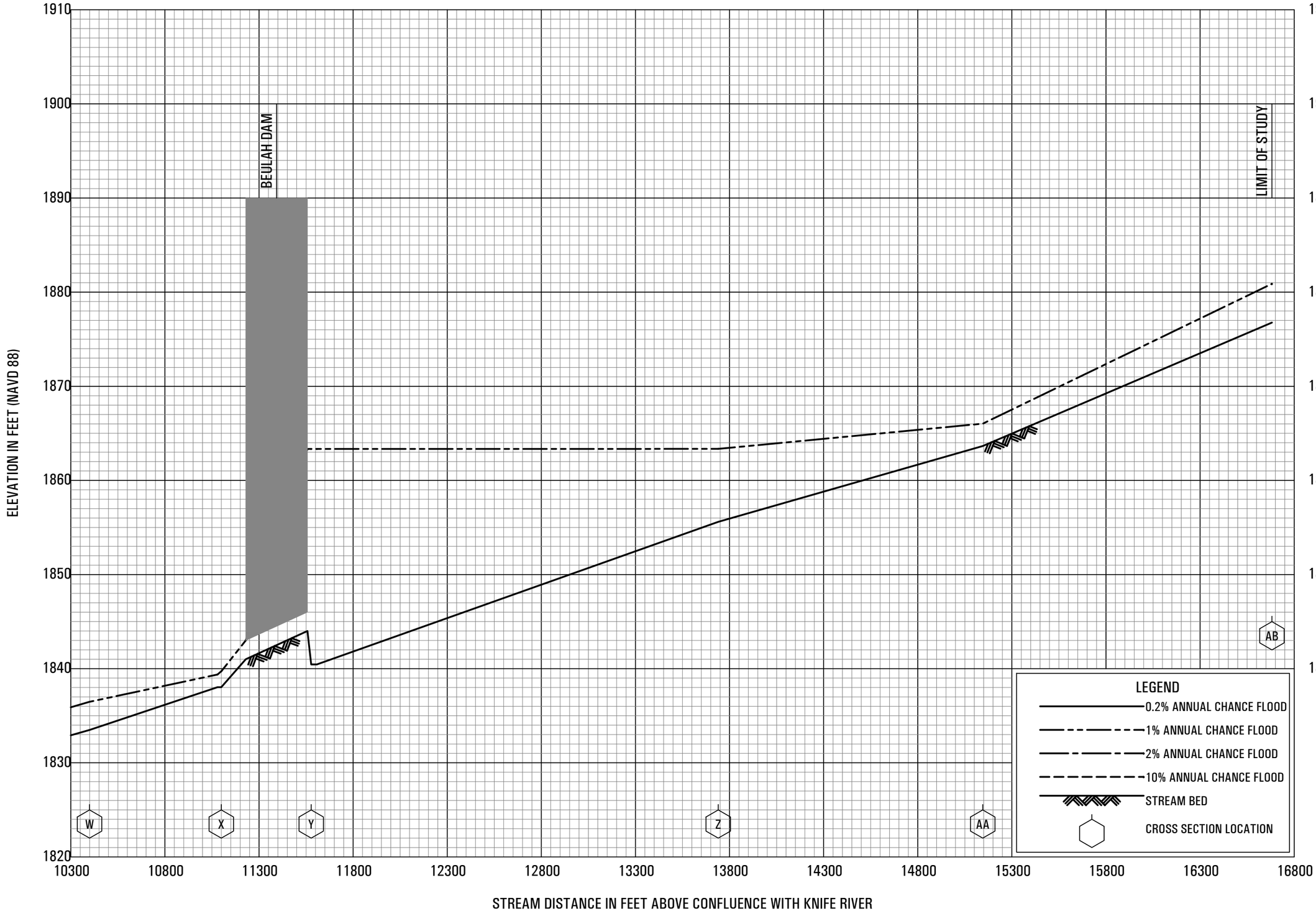

FLOOD PROFILES

EAST TRIBUTARY REACH #1 AT BEULAH, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS



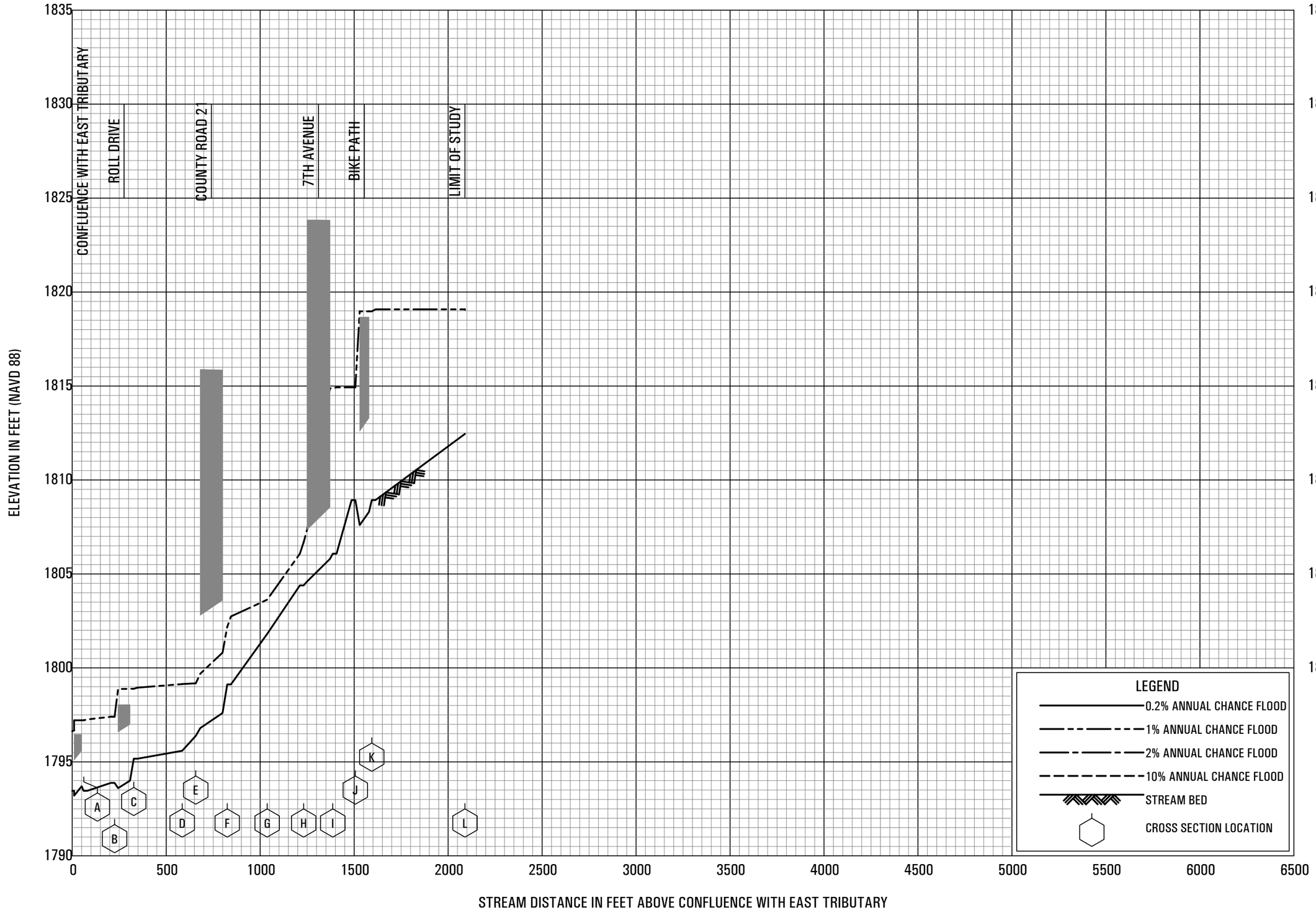

FLOOD PROFILES

EAST TRIBUTARY REACH #1 AT BEULAH, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS




FLOOD PROFILES

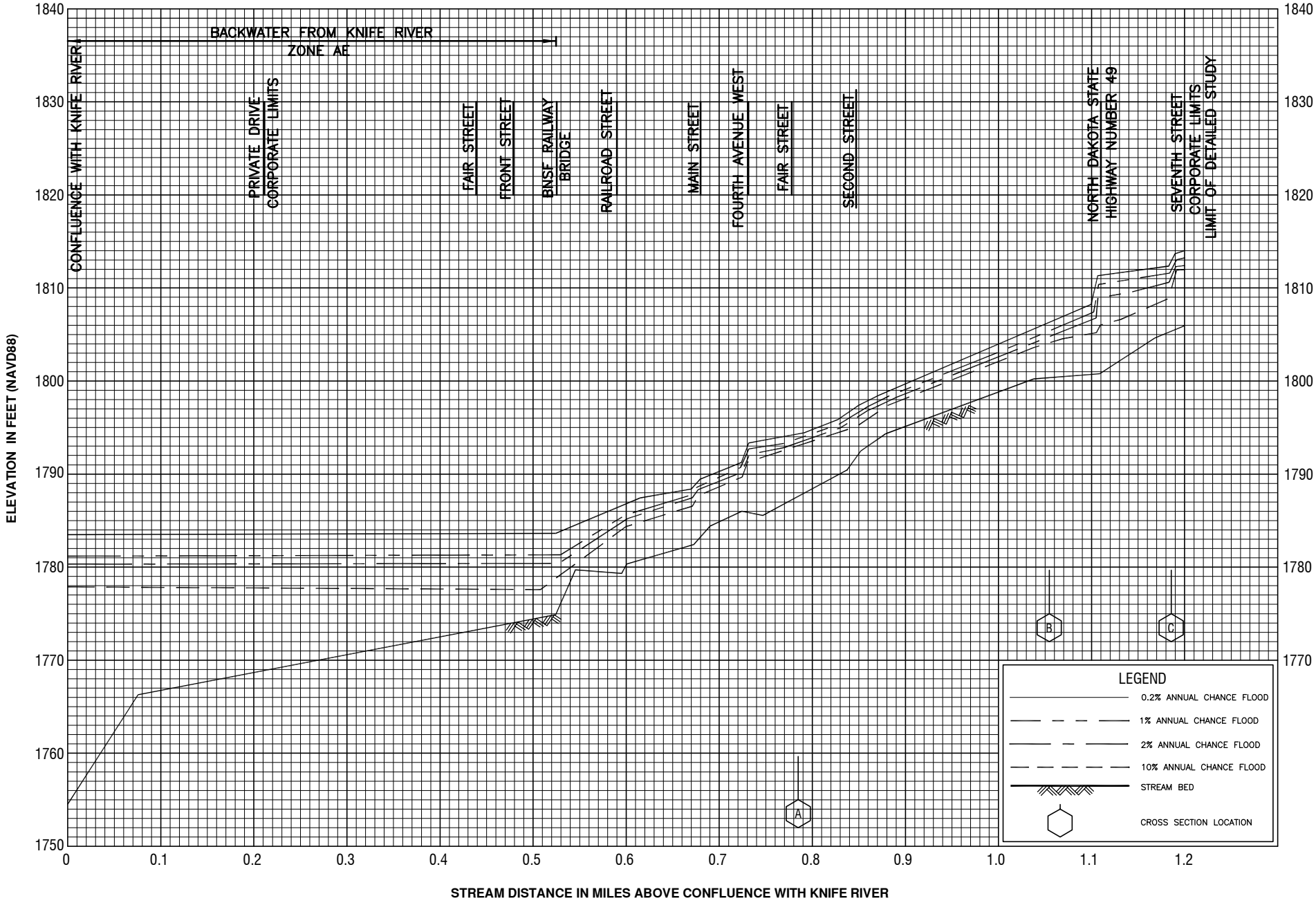
NORTH TRIBUTARY AT BEULAH, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

MERCER COUNTY, ND

AND INCORPORATED AREAS

15P




# FLOOD PROFILES

## WEST TRIBUTARY TO KNIFE RIVER AT BEULAH, ND

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MERCER COUNTY, ND**

AND INCORPORATED AREAS